## Halos and Mock Suns

ON Tuesday, July 20, about 5.15 p.m., I saw from this neighbourhood a most remarkable series of halos and parhelia, the general appearance of which is represented in the accompanying figure. (The parhelia at 120°, $P^{iii}$ and $P^{iv}$, cannot be represented in the figure.)

As I happened to have a theodolite near at hand, I measured the altitudes and azimuths of the parhelia and contact arches, and also of two points on the larger halo, with the following result :—

| | Azimuth by back angle | Altitude. | |
|---|---|---|---|
| Sun ... | 320° | ... 25° | |
| Parhelia | | | Angular distance from sun |
| $P^{i}$ ... | 347° | ... 25° | ... 27° |
| $P^{ii}$ ... | 293 | ... 25 | ... 27 |
| $P^{iii}$ ... | 80 | ... 25 | ... 120 |
| $P^{iv}$ ... | 200 | ... 25 | ... 120 |
| Contact-arch to inner halo | | | Radius of large halo from mean of two observations |
| Left extremity ($A^{ii}$) ... | 285° | ... 39° | |
| Right extremity ($A^{i}$) ... | 353 | ... 39 | ... 63° 30′ |

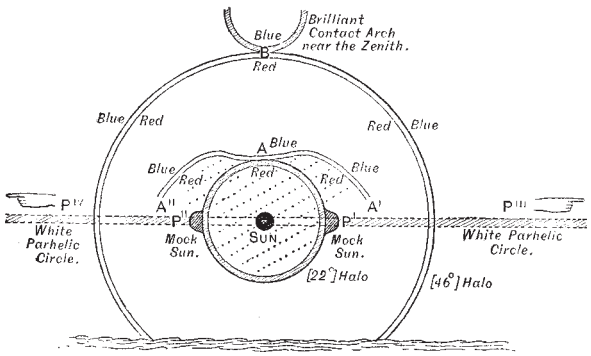
The positions of the two parhelia $P^{iii}$ $P^{iv}$ (or more properly speaking, *anthelia*) at 120° on either side of the sun, exactly accord with what is given in the text-books, but the solar longitude of the parhelia on the primary halo 27°, and the dimensions of the larger halo 63½°, usually given as 46°, are greater than those usually recorded.

The following features were observed :—

(1) The parhelion, $P^{ii}$ 27°, to the left of the sun, was very brightly visible before that on the right appeared at all.

(2) The parhelic circle appeared to encircle the entire sky, and to be everywhere of the same altitude—25°—as that of the sun.

(3) The contact arch, B, at the top of the larger halo, was remarkably brilliant, being red on the side adjacent to the sun,




and blue on that furthest from it, and appeared to be almost exactly at the zenith, thus supporting the somewhat rough measurements of the outer halo, which made it considerably larger than the traditional 46°.[1]

(4) The contact arches $A^{i}$ $A^{ii}$ were also very brilliant, and the space within them as well as that within the inner halo *h h* was much darker than that outside.

(5) The colours of the outer halo, H H, were similar to those of the inner halo, *h h*, viz. red inside and blue outside, but fainter.

(6) The parhelia attached to the inner circle $P^{i}$ $P^{ii}$ were similarly red inside and blue outside, while those at 120° were perfectly white.

The whole phenomenon lasted about twenty minutes, and was one of the most beautiful sights I ever saw. I was experimenting with a captive balloon at the time, or should have been able to make more detailed observations. I hear that on Monday night a deluge of rain of a tropical character fell at Dieppe. The cloud which caused these unusual optical phenomena appeared to be of the type termed by Poëy globo-cirrus. I shall be glad to hear if any corroborative measurements were made by other observers.

E. DOUGLAS ARCHIBALD

Tunbridge Wells, July

P.S. No parhelia were visible at the junction of the larger halo H H with the parhelic circle. Also there were no signs of the rare 90° radius halo. The radius of the inner halo was not measured, but as the lateral deviation of the parhelia $P^{i}$ $P^{ii}$ from the points in which it intersected the parhelic circle for a solar altitude of 25° should be about 2° 7′, this would make the radius of the inner halo 24° 53′ instead of 22° 30′ as is generally the case.

---

ON Tuesday afternoon, 20th inst., while sketching near Cranbrook, in the Weald of Kent, I saw a magnificent example of mock suns and solar rainbow circles.

From an early part of the day the sky had been, I think, more splendid in its cloud arrangements of cirro-cumulus than I have ever seen in this or any other country, though I have always been a delighted student of these phenomena. From 10 a.m. to about 4 p.m. there was an incessant change of loveliness in the forms and positions of the clouds and the remarkable perspectives thereby produced, to the intense admiration of myself and wife. But about 4 o'clock one half of the heavens from the horizon to the zenith became nearly covered with a thin stratum of dark clouds, which resembled more than anything else innumerable long bundles of cotton fibre, placed in every possible direction. The other half of the sky was of the richest and most delicate ultramarine as a background, and the fleecy *mare's tail* and *flocks of sheep* cloudlets as the subjects. On the dark strata of clouds the mock suns made their appearance, the real sun shining through the clouds with great intensity.

The whole phenomenon did not fade out till nearly 6 o'clock. As I saw it for some time reflected in a large sheet of water, I had good opportunities of studying it.

The setting of the sun that night was the most gorgeous pageant—myriads of golden streamers, in groups, being sent up from purple and scarlet clouds.

ROBERT H. F. RIPPON

Jasper Road, Upper Norwood, July 28

N.B. The clouds in the vicinity of the sun were slightly opalescent.—R. H. F. R.

---

## A Singular Case

ON March 2 last a small fishing-boat engaged in trawling at about 20 kilometres from the coast, off Monte Argentaro (Tuscan Maremma), captured a specimen of the Mediterranean Red Mullet (*Mullus barbatus*) tightly incased in a large colony of *Pyrosoma atlanticum*. The head of the fish had reached the bottom of the social cylinder, which fitted it to a nicety. The *Pyrosoma* measures 0·112 millimetre in length and 0·032 millimetre at its greatest transverse diameter; the mullet is 0·152 millimetre long, so that only 0·040 millimetre of its tail projects beyond the tightly-fitting *Pyrosoma!* The fish was taken *alive*, but how it could have lived in such conditions or how it got into its tight jacket is to me most enigmatical. Even admitting a certain amount of elasticity in the tight-fitting tube in which its head, body, and fins are incased, its movements could only have been very limited, and a very incomplete respiration and perhaps nutrition might have come to it through the orifices of the zooids.

Young fish, especially Scomberoids, are often found under the shelter of Medusæ and *Physalia*—the case of *Fierasfer* getting into the visceral cavity of *Holothuria* is well known; but it is the first time I have seen or heard of so singular a case of imprisonment as the one related above, and I therefore thought it worthy of the attention of the readers of NATURE. The specimen is preserved in alcohol in the rich ichthyological series of the collection of Italian Vertebrata in the Florence Royal Zoological Museum.

HENRY H. GIGLIOLI

Florence, July 29

---

## The Weather at Caracas

THE following notes on the weather at Caracas during the remarkable storm from May 11 to 15 may not be void of interest :—

We had a rather low barometer on May 8 (10 a.m., 682·93 mm.; 4 p.m., 681·99 mm.), but then it rose gradually till May 18 (685·42 and 683·17 mm. respectively). There had been no rain in the first twelve days of the month, but from

[1] Sun's altitude = 25°, radius of halo = 63½°, which would make the lower extremity of the top contact-arch 88½° above horizon.

© 1886 Nature Publishing Group

May 13 to 16 there fell 106 mm. rain, about *one-ninth* of our total yearly quantity; on the 13th, 26 mm.; 14th, 27·6; 15th, 22·4; 16th, 30. These heavy rains were undoubtedly due to the northern storm, although they came two days later.

Caracas, June 29 A. ERNST

### The Indivisibility of Certain Whole Numbers

ANOTHER exception has been found to Fermat's assertion regarding the indivisibility of whole numbers of the form $2^{2^m} + 1$ (see several notices in NATURE, vols. xviii. and xix.). The matter now stands as follows:—

$2^{2^5} + 1$ divisible by $5 \cdot 2^7 + 1$ (Euler)

$2^{2^6} + 1$ ,, $1071 \cdot 2^8 + 1$ (Landry)

$2^{2^{12}} + 1$ ,, $7 \cdot 2^{14} + 1$ (Pervouchine)

$2^{2^{23}} + 1$ ,, $5 \cdot 2^{25} + 1$ (Pervouchine)

$2^{2^{36}} + 1$ ,, $5 \cdot 2^{39} + 1$ (Seelhoff).

M.

### A Quadruped Duck

IT may interest some readers of NATURE to hear that there is at present living in Bardsea a duck which has four feet. The two abnormal feet, which are webbed like the others, and of the same shape and size, spring from one leg, which is about the same length as the normal legs, but rather thicker. This leg grows from a point just beneath the tail. Its bone does not seem to be directly connected with the other bones of the bird, as it can be freely moved in any direction. This duck is more than a month old, and is healthy. EDWARD GEOGHEGAN

Bardsea, August 3

## *PHYSIOLOGICAL SELECTION: AN ADDITIONAL SUGGESTION ON THE ORIGIN OF SPECIES*[1]

I.

THERE are three cardinal difficulties in the way of natural selection, considered as a theory of the origin of species.

(1) The difference between species and varieties in respect of mutual fertility. Many of our domesticated varieties differ from one another to an extent greater than that which distinguishes many natural species: yet they continue perfectly fertile *inter se*, while the natural species are nearly always more or less sterile. The difficulty is not met by pointing to the fact that sterility between natural species is neither absolutely constant nor constantly absolute; for the question still remains, Why are the modifications of organic types supposed to have been produced by natural selection, so generally attended with some more or less pronounced degree of mutual sterility, when even greater modifications of such types produced by artificial selection so generally continue mutually fertile? That this question does not admit of any answer by the theory of natural selection Mr. Darwin himself acknowledges, and therefore suggests a wholly independent hypothesis by which to explain the fact. This hypothesis is, that varieties occurring under nature "will have been exposed during long periods of time to more uniform conditions than have domesticated varieties, and this may well make a wide difference in the result." Now, whatever we may think of this hypothesis, it is certainly quite distinct from the theory of natural selection; and, therefore, any one who adopts the supplementary hypothesis is, so far, confessing the inadequacy of that theory, considered as a theory of the origin of species. For my own part, I deem the hypothesis wholly insufficient to meet the facts. When we remember the incalculable number of species, living and extinct, we immediately feel the necessity for some much more general explanation of their existence than is furnished by supposing that their mutual sterility, which constitutes their most general or constant distinction as species, was in every case due to some incidental effect produced on the generative system by uniform conditions of life. To say nothing of the antecedent improbability that in all these millions and millions of cases the reproductive system should happen to have been affected in this peculiar way by the merely negative condition of uniformity, there remains what seems to me the overwhelming consideration that, at the time when a variety is first forming, the condition of prolonged exposure must necessarily be absent as regards that variety: yet this is just the time when we must suppose that the infertility with its parent form arose. Because, if not, the incipient variety would have been reabsorbed into its parent form by intercrossing.

(2) For the swamping effects of free intercrossing upon an individual variation constitutes the next, and perhaps the most formidable, difficulty with which the theory of natural selection is beset. The only answer which Mr. Darwin has to make in this case is that a number of individuals inhabiting the same area may vary in the same way at the same time. Of course, if this assumption were granted, there would be an end of the present difficulty; for if a sufficient number of individuals were thus similarly and simultaneously modified, there need no longer be any danger of the variety being swamped by intercrossing. But the force of the difficulty consists in the very fact of this assumption being required to meet it. The theory of natural selection trusts to the chapter of accidents in the matter of variation; and in this chapter we read of no reasons why the same beneficial variation should arise in a number of individuals simultaneously. Moreover, if it does so, the fact of its doing so cannot be attributed to natural selection, which thus again fails as a theory of the origin of species. Lastly, as will immediately be shown, a very large proportion, if not the majority, of features which serve to distinguish species from species, are features presenting no utilitarian significance; and, therefore, even if it be conceded that they each arose in a number of individuals simultaneously, their reabsorption by intercrossing could not have been in any degree hindered by natural selection.

(3) The difficulty just alluded to of the inutility to species of so large a proportion of specific distinctions, is one which Mr. Darwin frankly acknowledges in the later editions of his works. In other words, he allows that a large proportion of these distinctions resemble the more general distinction of sterility in not admitting of any explanation by the theory of natural selection. They consist of small and trivial differences of form and colour, or of meaningless details of structure, which, being of no service to the plants or animals presenting them, cannot have arisen through the agency of natural selection. If it be suggested that all such distinctions are of disguised utility, the answer is that to offer this suggestion is to reason in a circle. For the only evidence we have of natural selection as an operating cause in any case is derived from the utility of the observed results: therefore, in cases where utility is apparently absent, we may not assume that it must be present only because, if it were not present, the results must be due to some cause other than natural selection. Observe, the case would be different if the great majority of specific distinctions—like the great majority of higher distinctions—were of obvious utilitarian significance; for in this case we might reasonably set down the exceptions as proof of the rule, or hold that they appear to be exceptions only on account of our ignorance. But it is certainly too large a demand on our faith in natural selection to appeal to the argument from ignorance when the facts require that the appeal should be made over so very large a proportion of instances. But it is needless further to insist upon this

[1] Abstract of a Paper read before the Linnean Society on May 6, by George J. Romanes, M.A., LL.D., F.R.S. &c.

© 1886 Nature Publishing Group